REMARKS

Claims 1, 6, 8, 18 and 21 are amended and claims 19 and 20 are canceled herein. Claims 2-5, 7 and 9 were previously canceled and claims 11-17 are withdrawn from consideration. Support for the amendment can be found, for example, in the specification on page 15, lines 21-22 and page 21, Table 1, Example Nos. 1-4. Hence no new matter is presented. Upon entry of the Amendment, which is respectfully requested, claims 1, 6, 8, 10-18 and 21 will be all of the claims pending in the application.

Claims 1, 6, 8, 18 and 21 are rejected under 35 U.S.C. § 112, 2nd paragraph as allegedly being indefinite with respect to the phrase "non-woven fabric having an average diameter of 10 micrometers."

Claims 1, 6, 8, 18 and 21 are amended herein to recite "an average fiber diameter", thereby obviating the rejection.

Accordingly Applicants respectfully request withdrawal of the rejection.

Claims 1, 18 and 21 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Harwood et al or Auerbach, each in view of Fukata.

Applicants respectfully traverse the rejection.

Claim 1 of the present application, as amended, recites a melt-blown, non-woven fabric having an average fiber diameter of 10 μm or less comprising polyarylene sulfide having a branched structure and a non-Newtonian coefficient of 1.05-1.20.

With respect to the non Newtonian coefficient, the Examiner states in Paragraph 5, page 3, lines 9-18, of the Office Action:

> Applicant argues that Fukata's range of .9-2 does not teach applicant's claimed range because it is a "very large range of

> polymer flow of almost all of the polymer structures including linear and branched." This argument is not persuasive because applicant has not produced evidence showing the criticality of the claimed narrower range within .9 and 2.0. Nor has applicant argued that said range is in fact critical to the invention such that Fukata would not have had possession of such knowledge. Moreover, .9-2 could not cover "almost all possible structures" because Fukata teaches values above 2, as high as 3, may be used. Fukata specifically narrows the range to values below 2 as a preferred embodiment (col. 4, lines 9-11). The Examiner also notes that Fukata's lower limit of .9 is extremely close to applicant's lower limit of 1.05.

Applicants respectfully submit that Fukata does not teach or suggest the narrower claimed range of the non-Newtonian coefficient, which is critical to the claimed invention. Sample Nos. 1-4 in Table 1 on page 21 of the specification of the present application show that the non-Newtonian Coefficient of the present invention is in a range of 1.05-1.20. Specifically, for emphasis, Table 1 on page 21 of the specification is rewritten based upon the non-Newtonian Coefficient N as shown in the following Table 2.

Table 2

Run	Non-Newtonian Coefficient N	Average Fiber Diameter (μm)	Process Condition
Comp. Ex. 2	1.00	13.1	Δ
Comp. Ex. 1	1.02	15.0	Δ
Example 4	1.06	5.7	O
Example 2	1.09	8.1	O
Example 1	1.03	7.5	O
Example 3	1.09	9.5	O
Comp. Ex. 3	1.22	17.3	Δ

In view of Table 2 above, the criticality of the non-Newtonian coefficient is clearly illustrated based upon a comparison between Comparative Example 1 and Example 4 and a comparison between Example 3 and Comparative Example 3.

"Process Condition" in the 4th column of Table 2 represents melt-blowing stability disclosed on page 20, lines 9-14, and page 21, lines 8-17, of the specification of the present application such that:

"O": Good melt blown stability without clogging the nozzles in a die and forming melt blown, non-woven fabrics having a uniform basis weight; and

"Δ" : Poor melt-blown stability with the nozzles often clogged in a die and forming melt blown, non-woven fabrics having a non-uniform basis weight.

That is, as is clear from the symbols " O " and "Δ" each showing the evaluation results of the process conditions, the difference between " O " and "Δ" is clearly found in whether or not the die clogging takes place.

Namely, to achieve the uniform structure of the fabrics with a uniform basis weight, fiber diameters of the fibers in the non-woven fabrics are required to be in a specified narrow range, for instance, a constant diameter in an ideal case. When fiber diameters of the fibers in the non woven fabrics are distributed in a wide range, for instance, each having an uneven diameter, the structure of the fabrics becomes not uniform, having a non-uniform basis weight. Accordingly, the uniformity of fiber diameters in the non-woven fabrics can be finally attributed to whether or not die clogging takes place.

In conclusion, die clogging causes the fiber diameters of the fibers to become small and, clogging the nozzles leads to the development of an accumulation of pressure in the die, which is

blown off, thereby making the fiber diameters thereof large. Accordingly, the expression of "good" or "poor" for "Melt-Blown Stability" in the 5th column of Table 1 on page 21 of the specification is clearly different.

As is clear from the foregoing, the actual behavior of PPS polymers greatly changes in the one hundredth unit of the non-Newtonian coefficients thereof, and the upper limit of the non-Newtonian coefficients is approximately 2.00 as previously shown (see RESPONSE dated November 5, 2002, page 3, the last paragraph to page 4, the 1 " paragraph and Fig. 4).

Now, a non-Newtonian coefficient is shown by the following equation (1'):

Shear Rate = (Shear Stress)^N (1'),
wherein K is a constant and N is a non-Newtonian coefficient.

Thus, Applicants have calculated the relation between Shear Rate (SR) and Shear Stress (SS) with respect to each N of 1.0, 1.2, 2.0, 3.5 and 25 under K obtained from a PPS polymer having N of 1.03 produced in our company, and the results are shown in Figs. 5 and 6 below.

Fig. 5

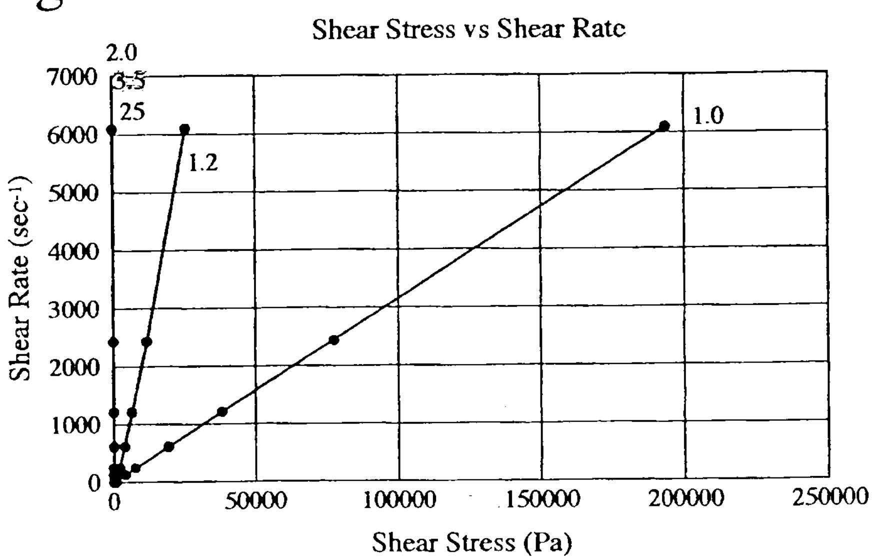
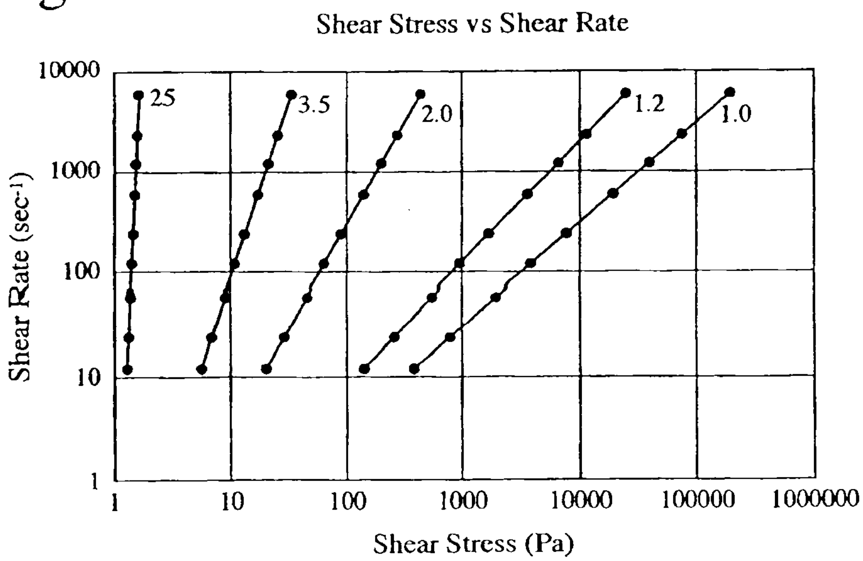


Fig. 6



In Figs. 5 and 6 above, each N value was calculated under a constant value of K. These figures clearly teach that the PPS polymers having N exceeding 2.0 produce a remarkable change in Shear Rate by any change in Shear Stress, and, accordingly, it is difficult to take a flow having N exceeding 2.0 into consideration.

Accordingly, the value of the non- Newtonian coefficient essentially in a range of about 1.00-2.00 is clearly evident from the simulations above. Therefore, it is clear that the range of "a non-Newtonian coefficient of 1.05-1.20" recited in the present invention is far narrower than Fukata's range of 0.9-2.

In addition, Applicants submit that the Examiner's statement that Fukata's lower limit of .9 is extremely close to applicant's lower limit of 1.05 is a misunderstanding. The fluid flow having N of about 0.9 -1.0 is generally called a "Newtonian flow" such as a flow of water, ethanol, or

the like, and the fluid flow having N of 1.05 is generally called a "non-Newtonian flow", each having specific flow properties different to each other.

Further, the Examiner states in Paragraph 5, page 4, lines 2-7, of the Office Action: "Figure 4 shows that melt flow rates between approximately 10 and 2000 poise result in applicant's narrow range of non-Newtonian coefficients. Harwood teaches melt viscosities within this range (col. 4, lines 16-55). Auerbach also teaches a melt viscosity within this range (p. 4, line 50). Therefore, according to applicant's evidence, both Harwood and Auerbach further refine and limit Fukata's range to a narrower range of about 1 to 1.3."

Applicants respectfully submit that this is also a misunderstanding. The non-Newtonian coefficient shows flow properties of a polymer and does not principally correlate with melt flow values. That is, although polymers may have the same melt flow value, if they are different in their flow properties, the non-Newtonian coefficients of these polymer should be quite different one another.

For instance, among the Examples in Table 1 on page 21 of the specification of the present application, although melt flow values of Example Nos. 1, 2, 4 and Comparative Example 4 are relatively comparable, their non-Newtonian coefficients are greatly different from one another as shown in the following Table 3.

Table 3

Run	Melt Viscosity V_6 (poise)	Non-Newtonian Coefficient N
Example 1	300	1.03
Example 2	295	1.09
Example 4	320	1.06
Comp. Ex. 1	310	1.02

For the record, Applicants note that Figure 4 presented in the previous Response filed on November 5, 2002, mainly plotted the relation between Non-Newtonian Coefficient (N) and Melt viscosity (V_6) described in the Examples of the specification of the present application, and, accordingly, their flow properties are relatively close to one another. However, it is evident that the non-Newtonian Coefficients greatly change even with approximately the same melt viscosity. That is, the Non-Newtonian Coefficient relates to the state of the branched or cross-linked structure of the PAS polymer, and thus it changes with the degree of the branched or cross-linked structure of the polymer, even though the melt flow values of PAS polymers are same.

Each of Harwood and Auerbach is silent regarding any of the degree of the branched or cross-linked structure of the PPS polymer and do not teach the relationship between the non-Newtonian coefficient and the degree of the branched or cross-linked structure. Thus, one skilled in the art would not have been motivated to modify or combine the cited references with a reasonable expectation of achieving the claimed invention of a melt-blown, non-woven fabric having an average diameter of 10 μm or less comprising polyarylene sulfide having a branched structure and a non-Newtonian coefficient of 1.05-1.20 as recited in claim 1.

Applicants submit that the Examiner's statement in paragraph 5, on page 4, in the 2nd and 3rd paragraphs of the Office Action that the present claims do not preclude the addition of a small amount of other materials is correct. However, the cited references, taken alone or in combination, do not teach or suggest a PAS having a branched structure or a cross-linked structure and a non-Newtonian coefficient of 1.05-1.20, as discussed above. Thus, the present invention is not rendered obvious by the prior art.

With respect to the Examiner's statement regarding claim 18 of the present application in paragraph 5, on page 4 of the Office Action, Applicants submit that the non-Newtonian coefficient of 1.0 5-1.20 is a critical feature of the claimed invention. Although Harwood specifically teaches using cross-linked PAS, Harwood is silent regarding a melt blown, non-woven fabric having an average fiber diameter of 10 μm or less comprising polyarylene sulfide having a cross-linked structure and a non-Newtonian coefficient of 1.05-1.20. As previously, discussed one of ordinary skill in the art would not have been motivated to combine Harwood or Auerbach with Fukata with a reasonable expectation of success in achieving the claimed invention. Thus, the present invention is not rendered obvious by the cited references, taken alone or in combination.

Claim 21 of the present application, which recites a melt-blown, non-woven fabric having an average fiber diameter of 10 μm or less according to claim 1 which has a non Newtonian coefficient of 1.06-1.19 is further distinguished over the art of record in view of the non-Newtonian coefficient range of 1.06-1.19, which is more narrow than the range recited in claim 1 (see Table 1, Examples 1-4 of the specification).

Thus, one of ordinary skill in the art would not have been motivated to combine the cited references with a reasonable expectation of success of achieving the claimed invention. Thus, the claimed invention is not rendered obvious.

Accordingly, Applicants respectfully request withdrawal of the rejection.

Claims 6, 8 and 10 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Harwood et al or Auerbach, each in view of Fukata and Senga.

Applicants respectfully traverse the rejection.

Claim 6 recites a melt-blown, non-woven fabric having an average fiber diameter of 10 mμ or less according to claim 1, wherein said polyarylene sulfide is a reaction product of an alkaline metal sulfide, a dihaloaromatic compound and a polyhaloaromatic compound having 3 or more halogen substituents in one molecule, and 0.01-0.3 mol %, based on 100 mol % of said alkaline metal sulfide, of said polyhaloaromatic compound is added in the reaction.

In paragraph 6, on page 5, lines 2-7, of the Office Action, the Examiner states that Senga teaches a common endpoint with applicant's claimed ratio.

Applicants respectfully submit that the endpoint of Senga is clearly different from that of the present application as shown in Table 4 below.

Table 4

	Addition Amounts of Polyhaloaromatic Compound to 100 Mol % of Alkalimetallic Sulfide (Mol %)
Present Application	0.01-0.3
Senga	0.135-6.5

In Table 4 above, Senga's endpoint was calculated as follows (please see page 9, second and third paragraphs, of the RESPONSE of November 5, 2002):

With respect to Senga

A molar ratio of Dihalogen Aromatic Compound (B)/Metallic Sulfide (A)

= 1.035/1 - 1.300/1, and

A molar ratio of Polyhaloaromatic Compound (C) (having three or more than three functional groups)/Dihalogen Aromatic Compound (B) = 0.003/1 - 0.05/1 (see Abstract: claim 5 and page 6, lines 5-8).

∴ A molar ratio of Polyhaloaromatic Compound (C)/Metallic Sulfide (A) = 0.003105/1 - 0.065/1.

∴ A molar ratio of Polyhaloaromatic Compound (C) to 100 Mol % of Metallic Sulfide (A) is 0.315 - 6.5 Mol %.

Thus, it is clear that this molar ratio of the polyhaloaromatic compound to the metallic sulfide ranging from 0.315 - 6.5 mol % of Senga (which does not include nor touch 0.3 mol%) is larger than the molar ratio of the polyhaloaromatic compound to the alkaline metal sulfide of 0.0001/1-0.003/1 derived from the amount of the polyhaloaromatic compound being preferably 0.01-0.3 mol % based on 100 mol % of the alkaline metal sulfide recited in claim 6 of the present application (emphasis added).

This means that Senga discloses highly branched PPS polymers, which should be quite different from the PAS polymers of the present application, even though compared with their products per se. Applicants further note that Senga's polyarylene sulfides, which are high in non-Newtonian behavior, do not have a cross-linked structure because the polyarylene sulfide

of the thermally cross-linked type present various disadvantages (emphasis added) (see page 2, lines 15-24, and page 3, lines 1-4 of EP '717).

None of the cited references of Fukata, Harwood, and Auerbach teaches a melt-blown, non-woven fabric having an average fiber diameter of 10 μm or less comprising polyarylene sulfide having a branched structure and a non-Newtonian coefficient of 1.05-1.20 as previously discussed and Senga does not remedy the deficiencies of these references.

Therefore, those skilled in the art would not have been motivated to modify or combine the cited references with a reasonable expectation of success in achieving the claimed invention. Thus, the claimed invention is not rendered obvious over the prior art.

With respect to claim 8, which depends from claim 18, the Examiner states:

> With respect to claim 8, applicant argues that none of the references teach applicant's claimed cross-linking method. However, both primary references do teach applicant's cross-linking. Therefore, it is the examiner's position that webs created by the combination set forth above arc identical to or slightly different than the webs prepared by the method of applicant."

Applicants respectfully submit that none of Fukata, Harwood and Auerbach teaches or suggests a melt-blown, non-woven fabric having an average fiber diameter of 10 μm or less comprising polyarylene sulfide having a cross-linked structure and a non-Newtonian coefficient of 1.05-1.20 as recited in claim 18 of the present application.

Harwood teaches a polyarylene sulfide fiber or the web surface thereof modified by hydrophilic or hydrophobic monomer either in the presence or absence of crosslinking agents (see column 10, line 22, to column 11, line 8), but it is silent regarding polyarylene sulfide per se having a cross-linked structure. Auerbach teaches that the polyarylene

sulfide per se having a cross-linked structure. Auerbach teaches that the polyarylene sulfide may be cross-linked, though it is preferably linear (see page 4, lines 40-44), but it ignores the thermal oxidation cross-linking treatment of a polyarylene sulfide produced by a reaction of the alkaline metal sulfide and the dihaloaromatic compound to obtain a cross-linked polyarylene sulfide having a non-Newtonian coefficient of 1.05 -1.20 (see page 9, line 10 to page 10, line 15, and page 11, line 25, to page 12, line 1 of the specification).

Further, Senga fails to teach at least the cross-linked PAS polymer having a non-Newtonian coefficient of 1.05-1.20 of the present invention (see page 8, lines 12-14) and the thermal oxidation cross-linking treatment of a polyarylene sulfide produced by a reaction of the alkaline metal sulfide and the dihaloaromatic compound to obtain a cross-linked polyarylene sulfide.

Further, it should be noted, as mentioned above that the cross-linked PAS polymer having a non-Newtonian coefficient of 1.05-1.20 makes it possible to carry out melt-blowing with good melt-blown stability without clogging the nozzles in a die to obtain non-woven fabrics having uniform structure with a uniform basis weight.

Therefore, those skilled in the art would not have been motivated to modify or combine the cited references with a reasonable expectation of success in achieving the claimed invention. Claim 10 is dependent upon claim 8 and is distinguished over the cited art for at least the same reasons.

Accordingly, Applicants respectfully request withdrawal of the rejection.

Claims 19 and 20 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Harwood et al or Auerbach, each in view of Fukata, Senga and either Yu, Stoner et al, or Ramsey.

Claims 19 and 20 are canceled herein thereby rendering the rejection moot.

Accordingly, Applicants respectfully request withdrawal of the rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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